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| 10/766,297 | 01/28/2004 | Yong Wang | 02-103 | 9519 |

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EXAMINER

PARSA, JAFAR F

ART UNIT

PAPER NUMBER

1621

DATE MAILED: 12/16/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

| | | | |
|------------------------------|--------------------------------------|------------------------------------|--|
| Office Action Summary | Application No. 10/766,297 | Applicant(s) WANG ET AL. | |
| | Examiner Jafar Parsa | Art Unit 1621 | |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 28 January 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-83 is/are pending in the application.
- 4a) Of the above claim(s) 73-83 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-72 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date <u>10/6/2005</u> | 6) <input type="checkbox"/> Other: _____ |

Election/Restrictions

Applicant's election without traverse of Group I, claims 1-72 in the reply filed on 9/27/2005 is acknowledged.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claims 1-72 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wang et al (USPN 2003/0129903) in view of Wang et al (USPN 6,558,634).

Applicants' claimed invention is directed to a process for converting a reactant composition comprising H₂ and CO to a product comprising at least one aliphatic hydrocarbon having at least about 5 carbon atoms, the process comprising: flowing the reactant composition through a microchannel reactor in contact with a Fischer-Tropsch catalyst to convert the reactant composition to the product, the microchannel reactor comprising a plurality of process microchannels containing the catalyst; transferring

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heat from the process microchannels to a heat exchanger; and removing the product from the microchannel reactor; the process producing at least about 0.5 gram of aliphatic hydrocarbon having at least about 5 carbon atoms per gram of catalyst per hour; the selectivity to methane in the product being less than about 25%. The disclosed invention also relates to a supported catalyst comprising Co, and a microchannel reactor comprising at least one process microchannel and at least one adjacent heat exchange zone.

Wang teaches a process for conducting exothermic reaction such as Tropsch-Tropsch synthesis ("FTS"), which is a highly exothermic reaction. FTS generally requires temperature control in a narrow range to avoid excessive methane production and catalyst deactivation. Microchannel reactors with straight and trapezoidal channel geometries (table 1) with jacketed active cooling system can be employed to collect reaction kinetics in various process conditions. Porous media containing catalytic materials are packed in the microchannel reactors. The catalysts are supported by packing thin layers of quartz wool and held by metal foams in both ends in a straight channel with the dimensions described in Table 1. Catalyst loading amount is 0.22 gram. The catalyst for this experiment can be prepared as follows. First, acidic gamma-alumina support powder (Engelhard) is ground and sieved to between 80- and 100-mesh (150 to 180-micron), and calcined (stabilized) at 350.degree. C. for 3 hours. This powder is then impregnated with a solution containing cobalt nitrate hexahydrate, ruthenium trichloride hydrate (or ruthenium nitrosyl nitrate), and lanthanum nitrate precursors, present in desired concentrations as to produce a 20-wt % cobalt, 1.37 wt %

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ruthenium, and 3 wt % lanthanum on alumina catalyst. The precursor solution is prepared in such a manner as to saturate the pore volume of the alumina support without over saturation of the alumina support. This powder is then dried in a vacuum oven at 110 C for at 12-hours. The powder is then calcined by heating at 350 C. for at least 3-hours. The hydrogen to carbon monoxide mole ratio in feed gas mixture is 2. The feedstocks are preheated to the reactor inlet temperature (248 C). Both reactors are operated at average conditions of 248 C., 295 psig, and 0.3 sec of contact time.

See paragraph 0057.

Wang teaches that the reaction microchannel comprising an inlet side and an outlet side; and wherein the reaction microchannel is adjacent at least one heat exchanger, and wherein the heat transfer distance from the reaction microchannel to the at least one heat exchanger is different on the inlet side than on the outlet side; and wherein the heat transfer distance is measured in a direction perpendicular to a direction of flow through the reaction microchannel. See claim 11. The reference inherently teaches that a methane selectivity of less than 25%, when the Fischer-Tropsch synthesis reaction is conducted in microchannel reactors adjacent to a heat exchanger.

The reference is silent about the rate of the hydrocarbon product per X gram of catalyst. However, it is well within the purview of one ordinary skill in the art to maximize productivity based on the total grams of solid catalyst when methane selectivity is minimized using microchannel reactors.

The dependent claims require a microchannel heat exchanger adjacent to

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microchannel reactors with particular characteristics. However, US patent 6,558,634 to Wang teaches a Fischer-Tropsch process carried out adjacent to a microchannel heat exchanger over a Co/Ru/alumina catalyst containing 15 wt % Co and 1 wt % Re on alumina and supported on metal foam to operate a Fischer-Tropsch synthesis at a hydrogen to carbon monoxide ratio of 3, at 231-275 C at 24 atmosphere and 1 second contact time to obtain 17-99.6% CO conversion for a methane selectivity of 9-36% the catalyst chamber has a thickness of 1.5 mm and a width of 8mm. See Example 1 and description of Figure 3. The use of microchannels in the heat exchanger enhances the heat transfer rate as compared to prior art methods not using microchannels. This allows for substantially greater heat transfer per unit volume of heat exchanger than may be achieved. It would therefore have been obvious to one of ordinary skill in the art at the time the invention was made to use these high efficiency microchannel heat exchangers in a variety of configuration, in order to enhance the heat transfer rate per unit volume of heat exchanger.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jafar Parsa whose telephone number is (571)272-0643. The examiner can normally be reached on 8 a.m.-4:30 p.m. (M-F).

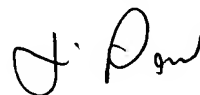
If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Johann Richter can be reached on (571)272-0646. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

JP

Jafar Parsa
Primary Examiner
Art Unit 1621



J. PARSA
PRIMARY EXAMINER